

Effects of the Sustained Computer Work on Upper Cervical Flexion Motion

SE-YEON PARK¹⁾, WON-GYU YOO^{2)*}¹⁾ Department of Physical Therapy, Graduate School, Inje University, Republic of Korea²⁾ Department of Physical Therapy, College of Biomedical Science and Engineering, Inje University and Elderly Life Redesign Institute: 607 Obangdong, Gimhae, Gyeongsangnam-do 621-749, Republic of Korea

Abstract. [Purpose] The purpose of this study was to evaluate the effect of sustained computer work on cervical flexion, especially the upper cervical region. [Subjects] We recruited 11 sedentary workers who used a computer for at least 4 hours a day. [Methods] Total range of cervical flexion, upper cervical flexion, and their ratio were measured before and after 1 hour of computer work. [Results] The total range of cervical flexion was not significantly different between pre-and post-measurement. However, upper cervical flexion, and the ratio between the upper cervical flexion and total cervical flexion significantly decreased after 1 hour of computer work, compared to pre-measurement. [Conclusion] Sustained computer work affects the range of cervical flexion, especially in the upper cervical region.

Key words: CROM, Cervical kinematics, Upper cervical

(This article was submitted Aug. 30, 2013, and was accepted Oct. 10, 2013)

INTRODUCTION

Active cervical range of motion (ROM) is frequently used to assess pain, and cervical ROM is reportedly one of the best estimators of cervical disability¹⁾. Previous reports have suggested that early changes in cervical ROM and muscle endurance could be interpreted as risk factors for the development of neck discomfort^{2, 3)}. In modern society, neck discomfort is regarded as one of the most prevalent types of pain among computer workers⁴⁾. Sustained computer work requires constant tension of the musculature of the rear neck region and can easily result in adoption of a forward-head posture^{3, 4)}. Previous work has suggested that cervical ROM during neck flexion could be a predictive factor for changes in neck posture and muscular dysfunction after sustained computer work^{5, 6)}. When assessing ROM of the cervical region, however, cervical flexion should be differentiated into total neck flexion and upper cervical flexion, because a forward-head posture is defined as the posture that adopts upper cervical extension and lower cervical flexion⁷⁾. Therefore, the purpose of the present study was to identify changes in cervical ROM after sustained computer work, especially with respect to upper cervical flexion, total neck flexion, and the ratio between these parameters.

SUBJECTS AND METHODS

Nine male office workers were recruited for the present study. They were aged 24 to 29 years (26 ± 3.2), and their mean height and weight were 174.5 ± 6.2 cm, and 75.3 ± 4.1 kg, respectively. The inclusion criterion was regular office workers who used a computer at least four hours per day. Exclusion criterion was a history of upper or lower extremity injury or disease that might have affected computer work. All subjects provided their informed consent before participating in this study. This study was approved by the Inje University Faculty of Health Sciences Human Ethics Committee. The total and upper cervical flexion angles were measured using a CROM instrument (Performance Attainment Associates, St. Paul, MN) before and after computer work. The instrument can measure the movements performed by the cervical spine, using inclinometers and a compass goniometer. A pressure biofeedback unit was placed at the lower cervical region, between the back rest and participant's head, below the C4 level, which is used for regulating lower cervical flexion, to provide pressure information. Each participant was asked to sit on a standard chair with a high backrest and maintain a neutral spinal alignment as perceived by an experienced physiotherapist. For measuring total cervical flexion, each subject was asked to flex the head until a feeling of muscle tightness or pain was occurred. For measuring upper cervical flexion, each subject was asked to flex the head until the pressure biofeedback unit showed a decrease in pressure. Three measurement trials were conducted at 60-s intervals, pre-and post-computer work. All participants performed selected computer work for 1-hour. Each participant was allowed 5-min of adjustment time to regulate the work circumstanc-

*Corresponding author. Won-gyu Yoo (E-mail: won7y@inje.ac.kr)

©2014 The Society of Physical Therapy Science. Published by IPEC Inc. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives (by-nc-nd) License <<http://creativecommons.org/licenses/by-nc-nd/3.0/>>.

Table 1 . Comparison of the angles of the total and upper cervical flexion, and ratio

Measurements	Mean $\pm$ SD	
	Before work	After work
Total cervical flexion ($^{\circ}$)	60.6 $\pm$ 4.8	59.4 $\pm$ 3.4
Upper cervical flexion ($^{\circ}$)	17.7 $\pm$ 2.2	11.8 $\pm$ 2.9*
Ratio	0.29 $\pm$ 0.02	0.19 $\pm$ 0.04*

* significant difference, $p < 0.05$

es to those most comfortable for them. The mean values of both measured values of the total cervical flexion and upper cervical flexion angles, and their ratios in the three trials, pre-and post-test, were calculated for statistical analysis. The paired t-test was conducted to examine differences. Significance was accepted for values of $p < 0.05$, and SPSS version 18.0 was used for statistical analyses.

RESULTS

The upper cervical flexion, and the ratio between the upper cervical flexion and total cervical flexion were significantly reduced after computer work, compared to pre-measurement ($p < 0.05$) (Table 1). The total cervical flexion angle was not significantly different between pre-and post-measurement ($p > 0.05$) (Table 1).

DISCUSSION

Reduced ROM in the cervical region can disturb functional activities and elicit protective responses, affecting changes in the muscular responses and passive structures of the cervical spine^{1, 2)}. The present results show that upper cervical flexion and its relationship to total cervical flexion were significantly reduced. Yoo et al.⁶⁾ reported a positive correlation between the magnitude of neck flexion and dysfunction of the cervical erector spinae. A previous work suggested that a prolonged abnormal posture results in impaired proprioception of “good posture” and repositioning sense^{8, 9)}. Although posture during computer work was not

evaluated in the present study, the nine subjects usually performed computer work with a forward-head posture, which might have influenced our results. The forward-head posture is defined as extension of the upper cervical region and flexion of the lower cervical region, which requires sustained activation of the cervical erector spinae at the C4 level^{2, 6)}. This manifests as muscular dysfunction of the cervical erector spinae in the rear neck, especially the upper cervical region.

ACKNOWLEDGEMENT

This research was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (No. 2012R1A1B4001058).

REFERENCES

- 1) Johnston V, Jull G, Souvlis T, et al.: Neck movement and muscle activity characteristics in female office workers with neck pain. *Spine*, 2008, 33: 555–563. [[Medline](#)] [[CrossRef](#)]
- 2) Szeto GP, Straker LM, O’Sullivan PB: A comparison of symptomatic and asymptomatic office workers performing monotonous keyboard work—1: Neck and shoulder muscle recruitment patterns. *Man Ther*, 2005, 10: 270–280. [[Medline](#)] [[CrossRef](#)]
- 3) Lee HJ, Nicholson LL, Adams RD: Cervical range of motion associations with subclinical neck pain. *Spine (Phila Pa 1976)*, 2004, 29: 33–40.
- 4) Sauter SL, Schleifer LM, Knutson SJ: Work posture, workstation design and musculoskeletal discomfort in a VDT data entry task. *Hum Factors*, 1991, 33: 151–167. [[Medline](#)]
- 5) Yoo WG, An DH: The relationship between the active cervical range of motion and changes in head and neck posture after continuous VDT work. *Ind Health*, 2009, 47: 183–188. [[Medline](#)] [[CrossRef](#)]
- 6) Yoo WG, Park SY, Lee MR: Relationship between active cervical range of motion and flexion-relaxation ratio in asymptomatic computer workers. *J Physiol Anthropol*, 2011, 30: 203–207. [[Medline](#)] [[CrossRef](#)]
- 7) Szeto GP, Straker LM, Raine S: A field comparison of neck and shoulder postures in symptomatic and asymptomatic office workers. *Appl Ergon*, 2002, 33: 75–84. [[Medline](#)] [[CrossRef](#)]
- 8) Dolan KJ, Green A: Lumbar spine reposition sense: The effect of a ‘slouched’ posture. *Man Ther*, 2006, 11: 202–207. [[Medline](#)] [[CrossRef](#)]
- 9) Edmondston SJ, Chan HY, Ngai GC, et al.: Postural neck pain: an investigation of habitual sitting posture, perception of ‘good’ posture and cervicothoracic kinaesthesia. *Man Ther*, 2007, 12: 363–371. [[Medline](#)] [[Cross-Ref](#)]